

sofAREPS-36

**Statement of Functionality (SOF) for
Advanced Refractive Effects Prediction System**

Document Version 3.6

18 December 2006

Prepared by:

**Space and Naval Warfare Systems Center, San Diego
Atmospheric Propagation Branch (2858)
San Diego, CA**

Table of Contents

1.	Scope.....	1
1.1	Identification	1
2.	Features.....	1
2.1	Tactical Decision Aids	1
2.2	Propagation Models	1
2.3	Self-defined Electromagnetic System Database	2
2.4	Surface Description.....	2
2.5	Atmospheric Refractivity	2
2.6	Operating System and AREPS Integration	2
2.7	Full-Featured Technical Support	2
3.	Applicable Documents	3
4.	Notes	4
4.1	Glossary of Acronyms	4
5.	Documentation Improvement and Feedback	4

This page intentionally left blank.

1. Scope

1.1 Identification

This Statement of Functionality (SOF) describes the Advanced Refractive Effects Prediction System (AREPS), version 3.6. This software is designed to run on a personal computer under Microsoft Windows 95, 98, NT 4.0, 2000, or XP operating systems.

2. Features

2.1 Tactical Decision Aids

The Advanced Refractive Effects Prediction System (AREPS) program computes and displays a number of electromagnetic (EM) system performance assessment tactical decision aids. These are radar probability of detection, electronic surveillance measure (ESM) vulnerability, HF to EHF communications, simultaneous radar detection and ESM vulnerability, and surface-search detection ranges. All decision aids are displayed as functions of range, bearing, and or height. Detection probability, ESM vulnerability, and communications assessments are based on electromagnetic (EM) system parameters stored in a changeable database you maintain. Paths containing land features depend on terrain data either obtained from the National Geospatial-Intelligence Agency's (NGA) Digital Terrain Elevation Data (DTED) or specified from your own source. Using a mouse or other pointing device, you may display many additional pieces of information, including height, range, latitude, and longitude from the decision aid's geographical center, terrain elevations, and propagation loss values.

2.2 Propagation Models

AREPS contains several EM propagation models for applications at various frequencies. For frequencies of 2 MHz to 57 GHz, AREPS uses the Advanced Propagation Model (APM). APM is a hybrid model that uses the complimentary strengths of both ray optics and parabolic equation methods to construct a fast, but yet very accurate, composite model. Depending upon the requirements of the tactical decision aid, APM will run in several different modes. For the full hybrid mode, APM has proven to be much faster than PE models alone, with overall accuracy at least as good as the pure PE models. With its airborne sub-model, APM can solve problems for very high elevation angles, that PE methods would not normally be used. APM includes the ability to model absorption by oxygen and water vapor.

For HF sky wave communications, AREPS uses a HF model suite consisting of a fully 3-dimensional ionosphere raytrace model, an HF field strength model, and an HF noise model. In addition to these EM propagation models, AREPS may optionally use two internationally recognized ionosphere models, the Parameterized Ionospheric Model (PIM) and the International Reference Ionosphere.

2.3 Self-defined Electromagnetic System Database

Detection probability, ESM vulnerability, and communications assessments are based on electromagnetic (EM) system parameters stored in a self-defined and changeable database. In addition to normal radar parameters, you may completely define the antenna radiation pattern to account for side-lobe considerations. The database also includes radar target descriptions and platforms' EM emitter suites.

2.4 Surface Description

AREPS considers range and bearing-dependent influences from surface features to include terrain elevation, finite conductivity, and dielectric ground constants. The terrain elevation data may be obtained from the National Geospatial-Intelligence Agency's (NGA) Digital Terrain Elevation Data (DTED) or specified from your own source. AREPS supports DTED level 0, 1, and 2 resolutions. The finite conductivity and dielectric ground constants may be selected from those defined by the International Telecommunication Union, International Radio Consultative Committee (CCIR) or specified from your own source.

2.5 Atmospheric Refractivity

AREPS considers range and bearing-dependent atmospheric refractivity data derived from the upper-air observations of radiosondes, other sensors, or mesoscale meteorological models. Radiosonde data may be manually entered or automatically decoded from either the World Meteorological Organization (WMO) observational message format or a free-form column format, obtained from a number of different data sources. In addition, climatological refractive conditions may be selected from a 921 WMO station, worldwide reporting database. For ocean reporting stations or numerical weather prediction grid points over the ocean, AREPS automatically calculates an evaporation duct refractive profile and appends it to the bottom of the upper-air observation for a complete description of the propagation environment.

2.6 Operating System and AREPS Integration

Because AREPS is a Microsoft Windows application, it is fully integrated with the operating system. AREPS takes advantage of object-linking and embedding (OLE) features such as file drag and drop and Windows clipboard functions such as cut, copy, paste, and undo. Menu text and toolbar icons are standard Windows design for ease of recognition and knowledge of functionality. AREPS supports the Windows Long Filename Convention (LFN) in addition to the Universal Naming Convention (UNC).

2.7 Full-Featured Technical Support

AREPS includes a "What's This Help" and a fully articulated on-line help. Within any AREPS window, you may point the "What's This Help" mouse cursor to any item and click the left mouse button. A "What's This Help" window displays with basic information about the particular item. Selecting the **Contents** item from the **Help** menu will launch a fully articulated on-line help with detailed instructions and guidance on every aspect of AREPS.

AREPS comes with a user manual. The manual is also included on the distribution CD-ROM in Adobe Acrobat format.

The Space and Naval Warfare Systems Center, San Diego, (SSC San Diego) atmospheric propagation branch provides telephone, facsimile, and electronic mail support for AREPS, including help with software-related problems or questions and training and consultation in the proper use of the AREPS products. Support is available between 7:15 a.m. and 4:45 p.m. Pacific Time, Monday through Thursday, excluding holidays. SSC working hours are such that every other Friday is a non-working Friday. Should support be requested on the non-working Friday, a telephone message may be left and a developer will return the call on the next working day.

For technical support via a toll call, dial (619) 553-1424; or via the Defense Switching Network (DSN), dial 553-1424. For technical support via the Internet, electronically mail questions to areps@spawar.navy.mil. For technical support via facsimile, dial (619) 553-1417.

Internet (<http://sunspot.spawar.navy.mil>.) or Secret Internet Protocol Router Network (SIRPNET) (<http://tsunami.spawar.navy.mil>) homepages are actively maintained. You may use these homepages to obtain the latest service pack, to request the complete AREPS program, to view other people's questions or ask your own, and to receive other announcements.

3. Applicable Documents

Barrios, A.E., "Advanced Propagation Model (APM) Computer Software Configuration Item (CSCI) Documents," SSC SD Technical Document 3033, 01 April 1998. This document contains three sub-documents describing APM CSCI Version 1.0: Software Requirements Specification (SRS), Software Design Description (SDD), and Software Test Description (STD). These are published in accordance with standards set by the Naval Oceanographic Office in "Software Documentation Standards and coding Requirements for Environmental System Product Development" of April 1990.

Commander-In-Chief, Pacific Fleet Meteorological Requirement (PAC MET) 87-04, "Range Dependent Electromagnetic Propagation Models," 1987.

Naval Oceanographic Office, "Software Documentation Standards and Coding Requirements for Environmental System Product Development," April 1990.

Naval Oceanographic Office, "Software Documentation Standards for Environmental System Product Development," February 1996.

Software Installation Procedures for Advanced Refractive Effects Prediction System, ipAREPS-36, 18 December 2006.

System Administrator's Manual for Advanced Refractive Effects Prediction System, samAREPS-36, 18 December 2006.

Statement of Functionality for Advanced Refractive Effects Prediction System, sofAREPS-36, 18 December 2006.

Software Test Description for Advanced Refractive Effects Prediction System, stdAREPS-36, 18 December 2006.

Software Version Description for Advanced Refractive Effects Prediction System, svdAREPS-36, 18 December 2006.

User's Manual for Advanced Refractive Effects Prediction System, umAREPS-36, 18 December 2006.

4. Notes

4.1 Glossary of Acronyms

APM	Advanced Propagation Model
AREPS	Advanced Refractive Effects Prediction System
CSCI	Computer Software Configuration Item
DTED	Digital Terrain Elevation Data
DSN	Defense Switching Network
EM	Electromagnetic
ESM	Electronic Surveillance Measures
JMV	Joint METOC Viewer
NGA	National Geospatial-Intelligence Agency
METOC	Meteorology and Oceanography
SDD	Software Design Description
SRS	Software Requirements Specification
SSC San Diego	Space and Naval Warfare Systems Center, San Diego
STD	Software Test Description
TEDS	Tactical Environmental Data Server
UHF	Ultra-high frequency
VHF	Very-high frequency
WMO	World Meteorological Organization

5. Documentation Improvement and Feedback

Comments and other feedback on this document should be directed to the Space and Naval Warfare Systems Center, Atmospheric Propagation Branch:

Phone: 619-553-1424

Fax.: 619-553-1417

Email: areps@spawar.navy.mil